Claims

1. Method for manufacturing a metal-ceramic substrate (1), in which (process) at least one metal area (3, 4) is applied to at least one surface side of a ceramic layer (2), characterized in that after applying the at least one metal area (3, 4), the ceramic layer (2) is heated, in a thermal treatment or process step, in an area not covered by the metal area (3, 4) along a separating or break-off line (6, 7) and then shock-cooled with a coolant so that this temperature change results in a controlled fracture (8) or weakening of material in the ceramic layer (2) along the separation or break-off line (6, 7).

2. Method according to claim 1, characterized in that the ceramic layer (2) is thermally separated or split along the respective separating line by means of the thermal treatment or process step.

3. Method according to claim 1, characterized in that a break-off line (6, 7) is produced in the ceramic layer (2) by means of the thermal treatment or process step, enabling subsequent controlled mechanical breaking of the ceramic layer (2).

4. Method according to one of the foregoing claims, characterized in that the thermal treatment or process step is executed progressively along the respective separating or break-off line (6, 7).

5. Method according to one of the foregoing claims,

characterized in that the heating of the ceramic layer (2) during the thermal treatment or process step is effected progressively in a treatment area that moves in relation to the ceramic layer.

6. Method according to one of the foregoing claims, characterized in that the heating of the ceramic layer (2) during the thermal treatment or process step is effected by means of an energy beam.

7. Method according to claim 6, characterized in that the heating of the ceramic layer is effected by a laser beam (9).

8. Method according to claim 6 or 7, characterized in that the heating of the ceramic layer is effected by means of a hot gas beam, a flame or a plasma.

9. Method according to one of the foregoing claims, characterized in that the heating of the ceramic layer (2) is effected by microwave energy.

10. Method according to one of the foregoing claims, characterized in that the cooling of the ceramic layer (2) during the thermal treatment or process step is effected progressively in a treatment area that moves in relation to the ceramic layer.

11. Method according to one of the foregoing claims, characterized in that the cooling of the ceramic layer (2) is effected progressively at a pre-defined spatial and/or temporal distance (x) from the heating.

12. Method according to one of the foregoing claims,

characterized in that the treatment of the ceramic layer (2) is effected with the coolant progressively and point by point.

13. Method according to one of the foregoing claims, characterized in that the coolant is applied to the ceramic layer (2) in the form of at least one coolant stream (12).

14. Method according to one of the foregoing claims, characterized in that the coolant is a liquid medium, for example water, a gaseous or vaporous medium or a mixture of these media, for example an aerosol.

15. Method according to one of the foregoing claims, characterized in that the ceramic layer (2) is held in a clamping fixture (11) during the thermal treatment or process step, preferably by means of a vacuum.

16. Method according to one of the foregoing claims, characterized in that the ceramic layer or the metal-ceramic substrate formed by said layer is located on a self-adhesive foil (18) for separation into single substrates (5).

17. Method according to one of the foregoing claims, characterized in that the thermal treatment is effected along a groove produced on at least one surface side of the ceramic layer (2).

18. Method according to one of the foregoing claims, characterized in that at least one metal area (3, 4) is applied to both surface sides of the ceramic layer (2).

19. Method according to one of the foregoing claims,

characterized in that the ceramic layer (2) is part of a multiple substrate (1), that a plurality of metal areas (3, 4), each allocated to one single substrate (5), are provided on at least one surface side of the ceramic layer (2), and that the separating or break-off lines (6, 7) are produced between the single substrates (5) through the thermal treatment or process step.

20. Method according to one of the foregoing claims, characterized by the use of a ceramic from the mullite group, AI_2O_3, AlN, Si_3N_4, SiC, BeO, TiO_2, ZrO_2, AI_2O_3 with a ZrO_2 content.

21. Method according to one of the foregoing claims, characterized by the use of a ceramic layer (2) with a thickness between 0.1 and 3 mm.

22. Method according to one of the foregoing claims, characterized in that the at least one metal area (3, 4) has a thickness between 0.02 and 0.6 mm, preferably a thickness between 0.1 and 0,6 mm.

23. Method according to one of the foregoing claims, characterized in that in the case of a plurality of metal areas (3, 4) on one surface side of the ceramic layer (2), said metal areas are at a distance of 0.1 - 3 mm from each other.

24. Method according to one of the foregoing claims, characterized in that the metal areas (3, 4) are manufactured at least partially from a metal layer or foil, for example a copper layer or foil, preferably using the direct bonding process or active soldering process.

25. Method according to one of the foregoing claims, characterized in that the at least one metal area (3, 4) is produced using the thick film process or thick film technology.

26. Method according to one of the foregoing claims, characterized in that the at least one metal area (3, 4) is produced using the Mo-Mn process and/or W process and/or LTCC process.

Amended Claims

1. Method for manufacturing a metal-ceramic substrate, in which a metallization forming a plurality of metal areas (3, 4) is applied to at least one surface side of a ceramic layer, and in which, after application of the metal areas, the ceramic layer is heated, in a thermal treatment or process step, in the areas not covered by the metal areas in order to produce separating or break-off lines (6, 7) between the metal areas (3, 4),
wherein the heating of the ceramic layer during the thermal treatment or process step takes place progressively and without vaporization or burning of the ceramic material in a treatment area that moves in relation to the ceramic layer, and that after the heating process the ceramic is likewise progressively shock-cooled so that a controlled fracture (8) or weakening of material is effected in the ceramic layer (2) in order to produce the separating or break-off line (6, 7).

2. Method according to claim 1, wherein the metal area of said metallization being bonded with the ceramic layer (2) by means of DCB bonding or active soldering process.

3. Method according to claim 1 or 2, wherein the at least one metal area (3, 4) is produced using the thick film process or thick film technology.

4. Method according to one of the preceding claims, wherein the at least one metal area (3, 4) is produced using the Mo-Mn process and/or W process and/or LTCC process.

5. Method according to claim 1, wherein the heating of the ceramic layer (2) during the thermal treatment or process

step is effected by means of an energy beam, namely a laser beam.

6. Method according to claim 5, wherein the laser beam is focused in order to form an oval focus, with its greater cross-section axis oriented in the processing direction (A).

7. Method according to one of the preceding claims, wherein the ceramic layer (2) is thermally separated or split along the respective separating line by means of the thermal treatment or process step.

8. Method according to one of the preceding claims, wherein a break-off line (6, 7) is produced in the ceramic layer (2) by means of the thermal treatment or process step, enabling subsequent controlled mechanical breaking of the ceramic layer (2).

9. Method according to one of the preceding claims, wherein the heating of the ceramic layer (2) during the thermal treatment or process step is effected by means of an energy beam.

10. Method according to claim 8 or 9, wherein the heating of the ceramic layer is effected by means of a hot gas beam, a flame or a plasma.

11. Method according to one of the preceding claims, wherein the heating of the ceramic layer (2) is effected by microwave energy.

12. Method according to one of the preceding claims, wherein the cooling of the ceramic layer (2) is effected

progressively at a pre-defined spatial and/or temporal distance (x) from the heating.

13. Method according to one of the preceding claims, wherein the treatment of the ceramic layer (2) is effected with the coolant progressively and point by point.

14. Method according to one of the preceding claims, wherein the coolant is applied to the ceramic layer (2) in the form of at least one coolant stream (12).

15. Method according to one of the preceding claims, wherein the coolant is a liquid medium, for example water, a gaseous or vaporous medium or a mixture of these media, for example an aerosol.

16. Method according to one of the preceding claims, wherein the ceramic layer (2) is held in a clamping fixture (11) during the thermal treatment or process step, preferably by means of a vacuum.

17. Method according to one of the preceding claims, wherein the ceramic layer or the metal-ceramic substrate formed by said layer is located on a self-adhesive foil (18) for separation into single substrates (5).

18. Method according to one of the preceding claims, wherein the thermal treatment is effected along a groove produced on at least one surface side of the ceramic layer (2).

19. Method according to one of the preceding claims, wherein at least one metal area (3, 4) is applied to both surface sides of the ceramic layer (2).

20. Method according to one of the preceding claims, wherein the ceramic layer (2) is part of a multiple substrate (1), that a plurality of metal areas (3, 4), each allocated to one single substrate (5), are provided on at least one surface side of the ceramic layer (2), and that the separating or break-off lines (6, 7) are produced between the single substrates (5) through the thermal treatment or process step.

21. Method according to one of the preceding claims, characterized by the use of a ceramic from the mullite group, AI_2O_3, AlN, Si_3N_4, SiC, BeO, TiO_2, ZrO_2, AI_2O_3 with a ZrO_2 content.

22. Method according to one of the preceding claims, characterized by the use of a ceramic layer (2) with a thickness between 0.1 and 3 mm.

23. Method according to one of the preceding claims, wherein the at least one metal area (3, 4) has a thickness between 0.02 and 0.6 mm, preferably a thickness between 0.1 and 0,6 mm.

24. Method according to one of the preceding claims, wherein in the case of a plurality of metal areas (3, 4) on one surface side of the ceramic layer (2), said metal areas are at a distance of 0.1 - 3 mm from each other.

25. Method according to one of the preceding claims, wherein the metal areas (3, 4) are manufactured at least partially from a metal layer or foil, for example a copper layer or foil, preferably using the direct bonding process or active soldering process.